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PATENT, TRADEMARK, COPYRIGHT AND RELATED INTELLECTUAL PROPERTY LAW

March 15, 2005

Mail Stop Certificate of Corrections Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Certificate
MAR 22 2005
of Correction

Re: U.S. Patent No.: 6,859,499 B2
Issued: February 22, 2005
Inventor: Hashimoto
Our Docket: 33857

Sir:

A Certificate of Correction under 35 U.S.C. 254 is hereby requested to correct Patent Office printing errors in the above-identified patent. Enclosed herewith is a proposed Certificate of Correction (Form No. PTO-1050) for consideration along with appropriate documentation supporting the request for correction.

It is requested that the Certificate of Correction be completed and mailed at an early date to the undersigned attorney of record. The proposed corrections are obvious ones and do not in any way change the sense of the application.

We understand that a check is not required since the errors were on the part of the Patent and Trademark Office in printing the patent.

Very truly yours,

Jeffrey J. Sopko, Reg. No. 27676

JJS:vln
Enclosures

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Mail Stop Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

Jeffrey J. Sopko
Name of Attorney for Applicant(s)

March 15, 2005
Date

Signature of Attorney

MAR 23 2005

PTO/SB/44 (07-03)
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,859,499 B2
DATED : February 22, 2005
INVENTOR(S) : Hashimoto

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 1

Line 39, please delete "(3)}+ϕ{g93)-g(4)}" and insert therefor --(3)}+ϕ{g(3)-g(4)}--.

Column 1

Line 43, please delete "(5)-g(6)-g(7)}" and insert therefor --(5)-g(6)}+ϕ{g(6)-g(7)}--.

MAILING ADDRESS OF SENDER: Jeffrey J. Sopko
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PATENT NO. 6,859,499 B2

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DEBLOCKING FILTERING APPARATUS AND METHOD

Background of the Invention

The present invention relates to the processing performed for a recovered image during a digital image compression process, and relates in particular to a deblocking filtering apparatus and method defined in MPEG-4.

For the processing of digital images, the internationally accepted MPEG digital image compression standards provide for the employment of a discrete cosine transform. This is an irreversible transform used for quantization, and depending on the condition of an original image, a phenomenon occurs whereby a pseudo outline having a block shape (block noise), which is inherent to the system, may appear in a recovered image.

As a countermeasure, Vertification Model 7.0 of the MPEG-4 video standards defines a deblocking filter as a post process for a recovered image. As is shown in Fig. 3, the defined deblocking filter performs filtering for ten received pixel values positioned around the block boundary, and outputs eight pixel values positioned around the block boundary. Two types of operation modes, a DC offset mode operation (hereinafter referred to as a D mode operation) and a default mode operation, are switched in accordance with a change value (hereinafter referred to as an activity) for the value of a pixel near

the block boundary. An evaluation function representing the activity employs the following equation (1).

$$f = \phi\{g(0)-g(1)\} + \phi\{g(1)-g(2)\} + \phi\{g(2)-g(3)\} + \phi\{g(3)-g(4)\} + \phi\{g(4)-g(5)\} + \phi\{g(5)-g(6)\} + \phi\{g(6)-g(7)\} + \phi\{g(7)-g(8)\} + \phi\{g(8)-g(9)\}$$

where

$$\text{if}(\text{abs}(x) <= Th1) \quad \phi(x) = 1;$$

$$\text{else} \quad \phi(x) = 0 \qquad \ldots (1)$$

According to an evaluation function f in equation (1), for ten pixel values positioned around a block boundary, an absolute differential value for the difference between adjacent pixel values is compared with a threshold value Th1, and a count is acquired of the locations whereat the absolute differential value is equal to or smaller than the threshold value Th1. If the value of the evaluation function f is equal to or greater than a threshold value Th2, i.e., when the activity is low, the D mode operation is selected. But if the value of the evaluation function f is smaller than the threshold value Th2, i.e., when the activity is high, the default mode operation is selected.

A more effective smoothing process is performed for a D mode operation than is performed for a default mode operation, as is illustrated by an operation equation (2) that is shown below. The smoothing process is performed if the absolute differential value between a maximum pixel value and a minimum